16. PRELIMINARY PROJECT SCHEDULE

This section presents the preliminary project schedules for the Fall Creek/White River Tunnel and the Flow Augmentation System projects. The preliminary project schedules presented herein reflect the total project duration, including the geotechnical exploration program, design and construction. This section also presents the available project delivery alternatives for design and construction. The schedule for a project of this magnitude will be affected by many factors including:

- Land and easement acquisition
- Construction sequencing
- Funding availability
- Equipment availability
- Duration of the regulatory review and permitting
- Project delivery method
- Application of multiple concurrent or consecutive construction contracts

16.1 PRELIMINARY PROJECT SCHEDULE

16.1.1 Fall Creek/White River Tunnel

The preliminary project schedule for the Fall Creek/White River Tunnel is presented in Table 16.1. The total project duration from the beginning of the consultant selection process through the completion of construction and tunnel start-up is estimated to be approximately 16 years.

16. PRELIMINARY PROJECT SCHEDULE

INSERT TABLE 16.1

16. PRELIMINARY PROJECT SCHEDULE

A preliminary project duration summary for the Fall Creek/White River Tunnel is presented in Table 16.2.

Table 16.2
Fall Creek/White River Tunnel Preliminary Project Duration Summary

Project Phase	Duration, months
Design Phase	65
Bid Phase	20
Construction Phase and Start-up	107
Total	192

The preliminary project schedule is based on the following assumptions:

- Tunnel is excavated and lined using one continuous construction contract or using more than one construction contract executed consecutively
- Tunnel excavation and lining will be a two-pass operation, whereby the entire tunnel will be excavated prior to commencement of the lining operations
- Consolidation sewers, drop shafts and connection tunnels are constructed concurrently with the main tunnel

The rate of excavation and lining of the main tunnel will have a significant impact on the duration of construction. The main tunnel advance rate assumption of 50 feet per day is based on construction in reasonably intact rock. The advance rate should be re-evaluated and adjusted, as necessary, based on the geologic and hydrogeologic characteristics ascertained during the geotechnical exploration program.

The project duration could be reduced by approximately three years, for a total project duration of 13 years, if the main tunnel was constructed in two segments (Fall Creek and White River) using two Contractors. One Contractor would begin at the working shaft on the southern end of the tunnel and the second Contractor would

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begin at the intermediate working shaft mid-way along the tunnel alignment. It is anticipated that the two segments would be completed approximately at the same time. This approach also may be required if the project is controlled by construction bonding limitations. This approach will add to the construction cost due to:

- Mobilizing two Contractors to the site
- Establishing working shaft operations at two locations
- Acquiring, mobilizing and assembling two large diameter tunnel boring machines (TBMs)
- Potentially requiring two intermediate shafts (one working and one retrieval) instead of one

The additional costs associated with two concurrent tunnel excavation contracts are estimated to be in the range of $20 million to $40 million. Furthermore, to address funding limitations or project goals, the main tunnel could be constructed in two segments (White River and Fall Creek) with the segments constructed consecutively. Using this approach, the White River segment could be placed into operation while the Fall Creek segment is under construction or constructed at a future date. This would require the upstream portion of the White River tunnel segment to be bulk headed while the Fall Creek tunnel segment is constructed. However, the Deep Tunnel Pump Station would need to be constructed at the conclusion of construction of the White River tunnel segment. This would allow the White River tunnel segment to be placed into operation before the Fall Creek segment is complete.

16.1.2 Flow Augmentation System

The Flow Augmentation System includes the Belmont Advanced Wastewater Treatment (AWT) Plant Effluent Pump Station, Belmont Force Main, and the Outfall Structures on Fall Creek, Pogues Run, and Pleasant Run. As presented in Table 16.1, the total duration from beginning of design through completion of the Flow Augmentation System construction and start-up is estimated to be approximately seven and a half years. It is anticipated that the Flow Augmentation System will be

16. PRELIMINARY PROJECT SCHEDULE

constructed by three separate Contractors working concurrently. The construction duration of the Belmont Force Main dictates the completion schedule. If desired by the City of Indianapolis Department of Public Works (DPW), the Belmont Force Main construction feasibly could be constructed in two segments concurrently. This would reduce the schedule by approximately one year, for a total of six and a half years.

A preliminary project duration summary for the Flow Augmentation System is presented in Table 16.3.

Table 16.3
Flow Augmentation System Preliminary Project Duration Summary

Project Phase	Duration, months
Design Phase	37
Bid Phase	20
Construction Phase and Start-up	35
Total	92

16.2 PROJECT DELIVERY ALTERNATIVES

When constructing a major project such as the Fall Creek/White River Tunnel and Flow Augmentation System, it is paramount to consider the various project delivery alternatives, as this will have a significant impact on the project duration and cost. Although there are a number of available project delivery alternatives, not all are feasible or desirable for the Fall Creek/White River Tunnel and Flow Augmentation System projects. The project delivery method should be determined prior to commencement of detailed design.

16. PRELIMINARY PROJECT SCHEDULE

The available project delivery alternatives include:

- Traditional Design-Bid-Build
- Traditional Design-Bid-Build with Construction/Program Manager
- Engineering-Procurement-Construction (EPC) or Design-Build
- Construction Manager At-Risk

16.2.1 Traditional Design-Bid-Build

In the United States, the design-bid-build approach is the traditional method of implementing many public works projects, including tunnels. With the design-bid-build approach, separate contracts are secured for both design and construction. The Contractor is selected based on the lowest responsive and responsible bid. The Contractor builds the facility with oversight by the Owner/Engineer for conformance to the Contract Documents.

The professional engineer, acting as a consultant to the Owner, performs the detailed design and prepares the construction Contract Documents. During the progress of design, several review milestones typically are incorporated that provides the Owner an opportunity to monitor progress and provide input into the design development. These review opportunities are considered to be the major benefits of the traditional design-bid-build approach. Following the completion of the design, the project is bid through the public bidding process governed by the laws of the State of Indiana.

The advantages of the traditional design-bid-build approach are listed below.

- Simplicity of management
- Cost security
- Owner actively involved in design process
- Engineer represents Owner's interest
- Cost competition among bidders
- Project delivered at the lowest cost

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- Complete set of plans and specifications for performance
- Predictable rights and responsibilities

Some of the disadvantages of the traditional design-bid-build approach are:

- Linear and sequential process leading to longer delivery time
- Actual cost determined after the completion of design with little chance to influence design without delays
- Tri-party nature of contract results in high potential for conflicts leading to litigation
- Owner warrants the adequacy of plans and specifications to the Contractor

As indicated above, the traditional design-bid-build approach has been used widely for water and sewage conveyance tunnels in the United States for the following reasons:

- Many state laws and Owners require competitive bidding (lowest responsive and responsible bidder) of construction projects
- There is comfort with the traditional process because of its extensive use
- Conveyance tunnels, diversion structures, pumping and treatment systems are complex
- Many municipalities prefer to maintain complete control of design development and provide input from the Owner's staff including engineering staff, operations and maintenance personnel and management to ensure the constructed facilities meets everyone's expectations
- Large construction funding often is not available or cannot be allocated at the on-set of the project as is often required for federally-funded and sometimes state-funded design-build projects

16. PRELIMINARY PROJECT SCHEDULE

16.2.2 Traditional Design-Bid-Build with Construction/Program Manager

Using this method, the Owner retains an engineering firm to manage the planning, design and construction phases of the projects using the traditional design-bid-build method. This process also is referred to as "construction management". A multiple-project program usually requires an expanded scope of construction management services, commonly referred to as "program management."

As the construction manager or program manager, the firm is responsible for managing the overall project, including awarding contracts, procuring materials, monitoring cost and schedule, and managing status reports and communications. To address the requirements of construction and program management, the firm provides the following services, which are tailored to meet the Owner's individual needs:

- Manage programming, planning, design and construction
- Provide specialized services as the Owner's agent
- Supplement/support the Owner's existing staff
- Provide a single point of management for the entire design and construction process
- Maximize front-end planning to reduce problems during execution
- Provide value engineering input and cost analysis
- Assemble bid packages
- Establish and maintain quality control standards
- Provide periodic reports reviewing the status of each project

16.2.3 Engineering-Procurement-Construction or Design-Build

Engineering-procurement-construction (EPC), also known as "design-build," is a process that provides a single point of responsibility for the design and construction of the project. Instead of design and construction occurring separately, the EPC team includes an Engineer and Contractor and the team is typically led by the

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Engineer. While the Owner establishes the terms of reference for the EPC work (e.g., project scope, quality and performance requirements, etc.), the EPC team plans, designs and constructs the project to meet the Owner's specified requirements. Benefits of the EPC process include:

- Single-point contractual responsibility
- Efficient and constructible designs
- Additional control of project schedule and cost
- Acceleration of the project schedule
- Improved coordination between designers and constructors
- Enhancement of overall "team" concept
- Promotes innovation
- Cost competitive
- Management of technology risk
- Enhancement of quality

The popularity of the EPC form of project delivery for civil infrastructure projects has grown significantly. Once limited to industry and private water companies, it has now become a valid option for many municipal utilities.

EPC can provide Owners with an effective means of managing technology and performance risk. By assigning “complete performance responsibility” through the EPC contract, the Owner can establish operational results that must be met before the completed project is accepted. Since design and construction are both the responsibility of the Design-Build Team, there can be no question as to who is responsible for poor performance. By preparing design-build specifications that are strictly performance based, the Owner also can promote innovation and benefit from the Design-Build team’s creativity. EPC is not currently legal in the State of Indiana. However, legislation is being considered to allow public works projects to be executed by EPC.

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16.2.4 Construction Manager At-Risk

When serving as a construction manager and a general contractor, the construction manager at-risk (CM At-Risk) provides design phase project management services including estimating, scheduling and value engineering. The CM At-Risk guarantees the construction cost of a project and serves as the general contractor. CM At-Risk services include:

- Advising and consulting on all aspects of planning
- Managing the design and construction phases
- Establishing the quality, cost and time parameters
- Providing engineering suggestions and cost analyses
- Preparing preliminary and detailed estimates
- Preparing bid packages
- Preparing the overall project schedule and providing periodic detailed updates
- Establishing and maintaining quality control standards
- Guaranteeing the construction cost
- Serving as the general contractor

16.2.5 Assumed Implementation Approach for Preliminary Design

The traditional design-bid-build project delivery approach was assumed for the preparation of this evaluation report, preliminary project schedule and preliminary opinion of probable project costs.

16.2.6 Number of Construction Contracts

The number of construction contracts for the Fall Creek/White River Tunnel will depend on the available funding, desired project duration, construction bond limitation, schedule and the maximum contract size to optimize construction and management costs. Table 16.4 provides a list of the estimated number of construction contracts for the Fall Creek/White River Tunnel.

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Table 16.4
Fall Creek/White River Tunnel Estimated Construction Contracts

Number of Contract(s)	Scope
1 - 3	♦ Main tunnel ♦ Working shaft ♦ Retrieval shaft ♦ Intermediate working shaft
1 - 10	♦ Consolidation sewers
1 - 20	♦ Drop shafts
1	♦ Connection tunnels
1	♦ Deep Tunnel Pump Station